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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/725,449

12/03/2003

Atsushi Yamada

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EXAMINER

MCDONALD, RODNEY GLENN

ART UNIT

PAPER NUMBER

1753

MAIL DATE

DELIVERY MODE

08/31/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/725,449

Applicant(s)

YAMADA ET AL.

Examiner

Rodney G. McDonald

Art Unit

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 25-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>12-3-03</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-24, drawn to a method of forming an apparatus with a first surface roughness and a second surface roughness, classified in class 204, subclass.192.32
- II. Claims 25-30, drawn to an apparatus, classified in class 257, subclass 1.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make another and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the process as claimed can make other products such as wafers instead of die placement areas or the product can be made by coating a rough coat instead of sputter or chemical etching.

During a telephone conversation with David Oren on August 16, 2007 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-24. Affirmation of this election must be made by applicant in replying to this Office action. Claims 25-30 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one

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or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 112

Claim 9 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 9 is indefinite because "the chip" lacks antecedent basis.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 13 and 20-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Hilton et al. (U.S. PG PUB. 2002/0060084 A1).

Regarding claim 13, Hilton et al. teach a process whereby a substrate 130 is obtained. (See Fig. 3). A die placement area is identified and a keep out area of the substrate is identified. (i.e. the die placement area is the area between treated regions 340 and the keep out area is the area from the regions 340 to the edge of the substrate 130) (See Fig. 3) A protective area 340 is formed over the substrate between the die placement area and the keep out area. (See Fig. 3; paragraph 0030) An underfill material 320 is formed over at least the die placement area of the substrate and the

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underfill material is prevented from flowing over the protective area based on surface roughness. (See Fig. 3; paragraph 0030; Here the examiner interprets "over" to mean completely over the area 340. In Figure 3 the underfill material does not flow over the edge of the area 340 as shown in the Figure. Therefore the underfill material does not flow "over" completely over the protective area) Furthermore, Hilton et al. teach providing a dam, barrier or discontinuity to prevent underfilling material from entering the keep out area. (Paragraph 0010)

Regarding claim 20, Hilton et al. teach attaching a die 110 over the die placement area of the substrate. (Fig. 3; Paragraph 0002, 0003)

Regarding claim 21, Hilton et al. teach flowing the underfill material between the die and the die placement area of the substrate. (Paragraph 002, 003, 0030)

Regarding claim 22, Hilton et al. teach that the underfill material flows in the die placement area without flowing to the keep out area based on the surface roughness of the die placement area and the surface roughness of the protective area. (See Paragraph 0030; The die placement area has an inherent roughness. The area 340 is roughened to prevent flow to the keep out area.)

Regarding claim 23, the protective area 340 is selected to avoid underfill overflow into the keep out area of the substrate. (See fig. 3; Paragraph 0030)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 2, 7-11, 14 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hilton et al. (U.S. PG Pub. 2002/0060084 A1) in view of Tsao (U.S. Pat. 6,288,451).

Regarding claim 1, Hilton et al. teach a method comprising selecting a protective area of a substrate. Providing a second surface roughness over the selected protective area of the substrate. (See Fig. 3; Paragraph 0030)

Regarding claim 2, Hilton et al. teach determining an area in which to prevent overflow of underfill material. (See Fig. 3; Paragraph 0030)

Regarding claim 8, Hilton et al. teach providing an underfill material over the first area of the substrate. (See Fig. 3; Paragraph 0030)

Regarding claim 9, Hilton et al. teach that the protective area is selected to avoid underfill overflow into a particular area of a chip. (See fig. 3; Paragraph 0030)

Regarding claim 10, Hilton et al. teach attaching a die over the first area of the substrate. (See Fig. 3; Paragraph 0002, 0003, 0030)

Regarding claim 11, Hilton et al. teach providing underfill material between the die and the substrate without overflowing the underfill material over all of the protective area. (See fig. 3; Paragraph 0030; Here the examiner interprets "over" to mean completely over the area 340. In Figure 3 the underfill material does not flow over the edge of the area 340 as shown in the Figure. Therefore the underfill material does not flow completely "over" the protective area)

Regarding 14, Hilton et al. teach a method comprising selecting a protective area of a substrate. Providing a second surface roughness over the selected protective area of the substrate. (See Fig. 3; Paragraph 0030)

The differences between Hilton et al. and the present claims is that Hilton does not teach a first surface roughness provided over a first area of the substrate (Claims 1, 14), Hilton does not teach the second surface roughness being different than the first surface roughness (Claims 1, 14) and Hilton does not suggest chemical etching (Claims 7, 19).

Regarding providing a first surface roughness over a first area of the substrate (Claims 1, 14), Tsao teaches providing a surface roughness between a die placement area and the substrate by chemical etching. (See Abstract)

Regarding the second surface roughness being different from the first surface roughness (Claims 1, 14), Tsao teaches providing a surface roughness between a die placement area and the substrate by chemical etching. The underfill material covers

the roughened area and is mechanically interlocked thereto. (See Abstract; Column 6 lines 12-32) Hilton et al. teach providing a surface roughness in a protective are to prevent the underfill from moving into a keep out area. (See Fig. 3; Paragraph 0030) Therefore, when Hilton et al. incorporates the teachings of Tsao the roughness in the die placement area would be different than the roughness in Hilton et al.'s protective because Hilton et al. is preventing underfill from moving into the keep out area whereas Tsao allows the underfill material to flow but increases adhesion to the substrate.

Regarding claims 7, 19, Hilton et al. teach etching can be used to remove material. (Paragraph 0014) Tsao teach utilizing chemical etching to provide roughness. (Column 6 lines 26-27)

The motivation for utilizing the features of Tsao is that it allows for better adhesion of the die to the substrate. (column 6 lines 22-23)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Hilton et al. by utilizing the features of Tsao because it allows for better adhesion of the die to the substrate.

Claims 3, 4, 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hilton et al. in view of Tsao as applied to claims 1, 2, 7-11, 14 and 19 above, and further in view of Banks et al. (U.S. Pat. 4,329,385).

The differences not yet discussed is providing the surface roughness by sputter etching through a mask (claims 3,15) and where the sputtering provides less sputtering to the protective area than the first area (claims 4, 16).

Regarding claims 3, 15, Banks et al. teach sputter etching through a mask to form a roughened surface. (Column 1 lines 52-57)

Regarding claims 4, 16, controlling the amount of sputtering to the different areas is obvious given that Tsao and Hilton et al. discuss different roughness for different areas to control movement of the underfill material. (See Tsao and Hilton et al. discussed above)

The motivation for utilizing the features of Banks et al. is that it allows for forming a roughened surface. (Column 1 lines 52-57)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the features of Banks because it allows for forming a roughened surface.

Claims 5, 6, 17, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hilton et al. in view of Tsao and Banks et al. as applied to claims 1-4, 7-11, 14-16 and 19 above, and further in view of Maydan et al. (U.S. Pat. 4,298,443).

The differences not yet discussed are the use of oxygen plasma sputtering (Claims 5, 17) and the use of hydrogen plasma sputtering (Claims 6, 18).

Regarding claims 5, 6, 17, 18, Maydan et al. teach that sputter etching can be carried out in the gases of oxygen or hydrogen. (Column 6 lines 32-41)

The motivation for utilizing the features of Maydan et al. is that it allows for sputter etching a substrate. (Column 6 lines 32-41)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the features of Maydan et al. because it allows for sputter etching a substrate.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hilton et al. in view of Tsao as applied to claims 1, 2, 7-11, 14 and 19 above, and further in view of Dias (US PG PUB 2003/0109080 A1).

The differences not yet discussed is the use of a solder resist. (Claim 12)

Regarding claim 12, Dias teaches a process utilizing a solder resist on a substrate for a die bonding process. (Page 3 paragraph 0039).

The motivation for utilizing the features of Dias is that it allows for bonding a die to a substrate. (Page 3 paragraph 0039)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the features of Dias because it allows for bonding a die to a substrate.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hilton et al. in view of Dias (US PG PUB 2003/0109080 A1).

Hilton et al. is discussed above and all is as applies above. (See Hilton et al. discussed above)

The difference between Hilton et al. and the present claims is where the substrate includes a solder resist. (Claim 24)

Regarding claim 24, Dias teaches a process utilizing a solder resist on a substrate for a die bonding process. (Page 3 paragraph 0039).

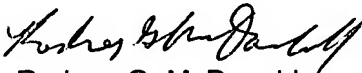
The motivation for utilizing the features of Dias is that it allows for bonding a die to a substrate. (Page 3 paragraph 0039)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Hilton et al. by utilizing the features of Dias because it allows for bonding a die to a substrate.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M-TH with every Friday off..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Rodney G. McDonald
Primary Examiner
Art Unit 1753